
```
%Charles Keer
%Controls HW 4
```

```
clear
clc
close all
```

```
%Problem 2a. Verify each problem in Part 1 in MATLAB
```

```
%Problem 1A
%Find the steady state error of the uncontrolled system.
```

```
%Plot the E(s) equation minus the step response
Numerator=[1,2,3];
Denominator=[1,2,8];
TransferFunction=tf(Numerator, Denominator)
stepplot(TransferFunction,8)
figure
```

```
%Problem 1B
%Verify the value for Kp reduces the error by 90%
%Plot the E(s) equation minus the step response
Numerator=[1,2,3];
Denominator=[1,2,80];
TransferFunction2=tf(Numerator, Denominator)
stepplot(TransferFunction2,8)
figure
```

```
%Problem 1C
%Verify the integral controller eliminates the SSE and that the system is
%stable
%Plot the E(s) equation minus the step response
Numerator=[1,2,3,0];
Denominator=[1,2,3,5];
TransferFunction3=tf(Numerator, Denominator)
stepplot(TransferFunction3,100)
figure
%Determine if the system is stable
roots([1,2,3,2.5])
%Since the real part of the root is negative, the system is stable
```

```

%2b
%Find a value for KD with a settling time of less than 2 seconds
kd=1.25;

Numerator=[0,5*kd,10,12.5];
Denomenator=[1,2+(5*kd),13,12.5];
TransferFunction4=tf(Numerator, Denomenator)
stepplot(TransferFunction4,10)
stepinfo(TransferFunction4)

TransferFunction =

      s^2 + 2 s + 3
      -----
      s^2 + 2 s + 8

Continuous-time transfer function.
<a href="matlab:ltipack.util.ModelPropertyDisplay.getInstance.show">Model
Properties</a>

TransferFunction2 =

      s^2 + 2 s + 3
      -----
      s^2 + 2 s + 80

Continuous-time transfer function.
<a href="matlab:ltipack.util.ModelPropertyDisplay.getInstance.show">Model
Properties</a>

TransferFunction3 =

      s^3 + 2 s^2 + 3 s
      -----
      s^3 + 2 s^2 + 3 s + 5

Continuous-time transfer function.
<a href="matlab:ltipack.util.ModelPropertyDisplay.getInstance.show">Model
Properties</a>

ans =

-0.3898 + 1.3772i
-0.3898 - 1.3772i
-1.2204 + 0.0000i

TransferFunction4 =

      6.25 s^2 + 10 s + 12.5
      -----
      s^3 + 8.25 s^2 + 13 s + 12.5

```

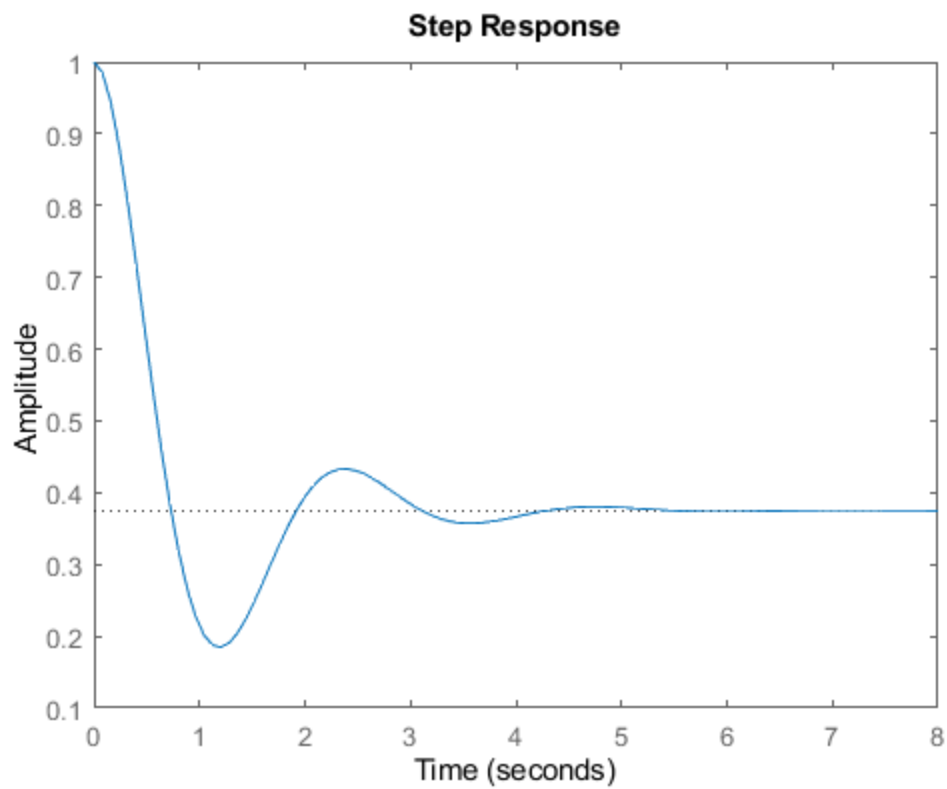
Continuous-time transfer function.

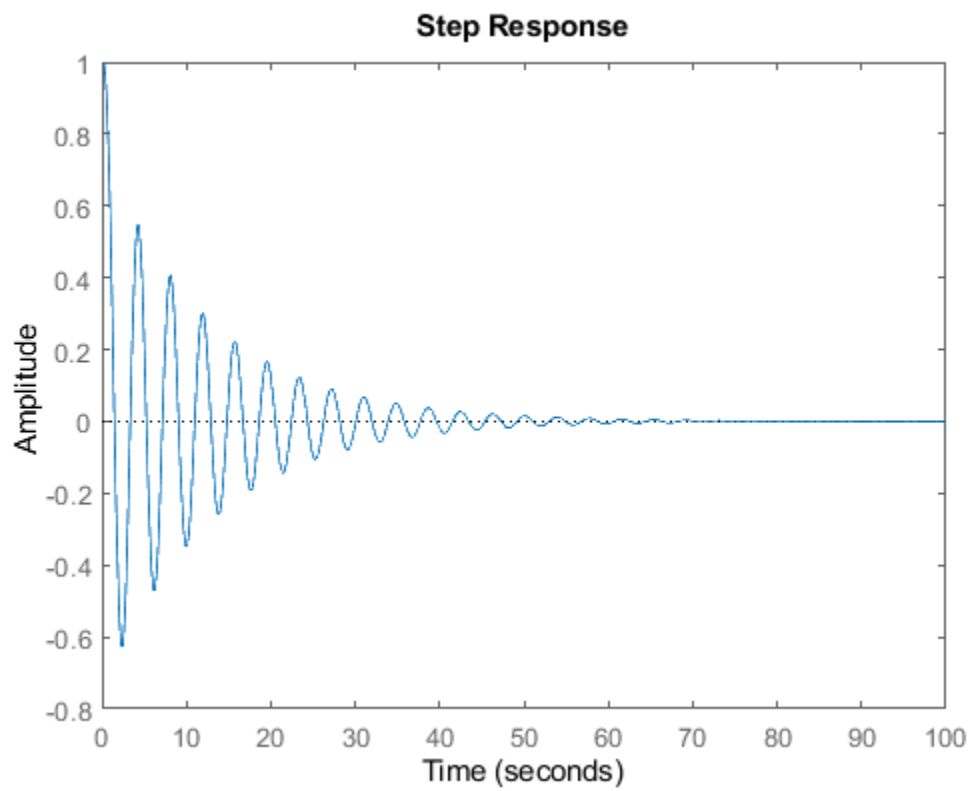
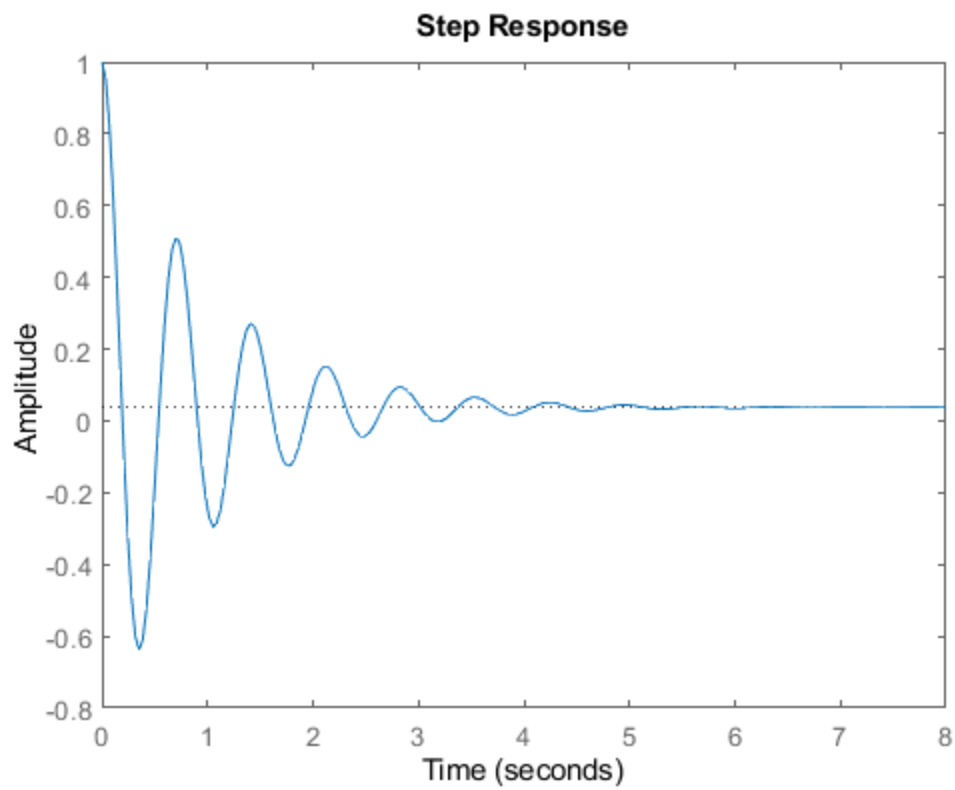
[Model Properties](matlab:ltipack.util.ModelPropertyDisplay.getInstance.show)

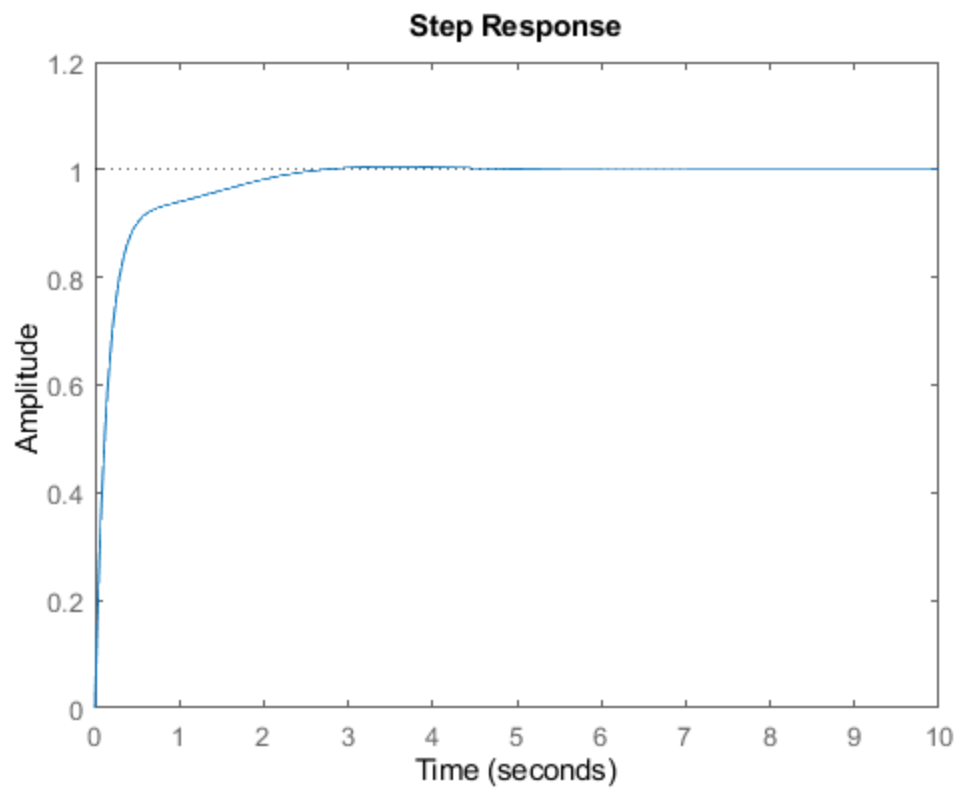
ans =

struct with fields:

RiseTime: 0.4796
TransientTime: 1.9467
SettlingTime: 1.9467
SettlingMin: 0.9020
SettlingMax: 1.0054
Overshoot: 0.5436
Undershoot: 0
Peak: 1.0054
PeakTime: 3.3564







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